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Two Years with the Birds on a Farm.

By EDWARD HOWE FORBUSH,
Ornithologist, Massachusetts State Board of Agriculture.

Lecture delivered at the Public Winter Meeting of the Massachusetts State Board of Agriculture, at North Adams, Dec. 2, 1902.

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TWO YEARS WITH THE BIRDS ON A FARM.

By Edward Howe Forbush, Ornithologist, Massachusetts State Board of Agriculture.

Some investigations made by your ornithologist, under the auspices of this Board, in the last years of the nineteenth century, gave you abundant evidence of the usefulness of the smaller land birds in orchard and woodland; but no opportunity offered to study the influence exerted by birds on small fruit and vegetable growing until the year 1900.

This lecture is, mainly, the result of observations made by your ornithologist while at work on the land, and, much of the time, in his kitchen garden. The facts ascertained are such as any other observing farmer might gather, were he familiar with our common birds. The observations of which this lecture constitutes a partial record were begun in July, 1900, and have been continued up to a very recent date.

Since it is intended to pursue these investigations further in the same field for the benefit of this Board, it may be well first briefly to describe the geographical position of the farm, climate, soil, flora and fauna. The place is situated in Wareham, Mass., on the north bank of the Agawam River, near its junction with the Wankinco. These two rivers, uniting here, form the Wareham River, a tidal stream. The salt water flows for some distance up each of these tributaries, and, returning, empties into Buzzard's Bay three miles below.

The farm was selected as one lying directly in the migration route of both land birds and water birds, and is well adapted to sustain a large and varied bird population. It lies near the head of Buzzard's Bay, in or near the line of flight of those migrating sea and shore birds which come up along the waters or shores of Long Island Sound in their northward migrations, and, crossing the mouth of Narragansett Bay, pass up Buz-

zard's Bay or its west shore, crossing Wareham and Plymouth, and thus reaching the shores or waters of Cape Cod Bay, leaving Cape Cod out of their itinerary. The distance saved by such a course is from fifty to one hundred miles.

Observation shows that many birds take advantage of this saving of time and distance both in their northward and southward journeyings, though many more follow on around the devious shores of the Cape. Flights of land birds which have crossed the comparatively narrow channels of Narragansett Bay into Tiverton, Westport and Dartmouth are checked and turned northward by the broad expanse of Buzzard's Bay, most of them passing up its western shore, and, becoming somewhat massed here, spread out again over Wareham, Plymouth, Carver and Middleborough, on their way northward and eastward. The field of observation, therefore, is particularly favorable for the study of certain migrating birds.

The winters are comparatively mild, with more rain and less snow than falls in western Massachusetts. The thermometer usually remains well above zero, dropping below that point occasionally, but seldom remaining long below it. Snow does not often lie at great depth, or long at a time. In winter the bird population is comparatively large. We are somewhat protected from the east and northeast winds, which sweep the coast of Massachusetts Bay, by a tract of hilly and partially wooded country, sixteen miles wide, which lies between the head of Buzzard's Bay and the coast at Plymouth. Many birds, which forsake the colder and more snowy regions of the State in winter, remain along the shores of Buzzard's Bay all this inclement season. Jays, crows, flickers and cedar birds are commonly seen. Song sparrows, robins, shore larks, myrtle warblers and other land birds are more or less plentiful, in addition to the usual winter residents or migrants. Gulls and certain other sea birds winter here in some numbers. For the past two winters a kingfisher has been seen along the river, and swamp sparrows and meadowlarks are sometimes seen.

The extreme heat of summer is tempered here by the southwest winds, which come laden, not with heat, as in many parts of the State, but with the cooling influences of the broad Atlantic and the salt flavor of the bay. The soil of the uplands is largely

of a sandy or gravelly nature, with some clay deposits. Here and there rocks, left by the ancient continental glaciers, lie near the surface, either projecting above the ground or buried at moderate depths. As is the case with most soils of glacial origin, there is usually a greater variety in the character of the soils of limited areas (such as are contained in the ordinary farm) than in soils otherwise formed. One may readily pass at a single step from a dry and sandy soil to one very retentive of water, where he will sink into mud ankle deep. The soil being thus varied, the vegetation is, in consequence, quite diversified. We have not only the pitch pine, scrub oak, poverty grass, beach plums and bearberry of the stratified sands of Cape Cod, but also the birches, elms, oaks, maples, hornbeams, sassafras, white pine and cedars of a more fertile soil. These and other trees both of the coast region and the interior flourish here, with a profusion of berries of native kinds, except perhaps the raspberry, high blackberry and wild strawberry, none of which is plentiful. There are very few nut and ash trees or white oak groves. There is a profusion of wild flowering plants, a great variety of shrubbery, and there are some grasses which are not found in the interior.

A few birds that are common on the rocky hillsides of the western part of the State are not common in Wareham or its vicinity; but their absence is more than made up by the greater number of water, shore and marsh birds found here.

The tract of land which has been kept under observation consists of the farm, extending from the highway at the north to the water way — the river — at the south, together with the lands adjacent, and the waste lands in which the river rises and out of which it flows. From the shore of the river at the southern boundary of the farm we may look across a fine sheet of water, where the three rivers join, to the village at Wareham station. Beneath these waters oysters, clams and quahaugs grow naturally. The river at times swarms with edible migratory fish. Shrimp, crabs and other aquatic and marine forms of life abound.

Such a variety of food animals is sure to attract water birds. Down the river, toward the bay, gulls or terns, or both together, may be found according to the season. Bay ducks are not

wanting. Loons and grebes come and go. The upper river, flowing through salt marshes backed by pine woods, offers secluded retreats for eagles, fish hawks, herons, bitterns and various water fowl and shore birds. One large, solitary pine tree standing on our shore has been used for at least two years, in the fishing season, by an immense bald eagle as a perch, from which he watches the evolutions of the fish hawks.

If we follow the river above the head of tide water toward the Plymouth woods, we shall see another feature of this region which renders it attractive to birds. Here lies an uninhabited country. There are no dwellings and no fences. The only buildings to be seen are the "bog houses," where cranberries are housed, screened and packed for shipment each fall. The land is undulating, consisting of a series of low hills, with occasionally a well-watered valley. Many of these valleys have been made into cranberry bogs. There are many natural ponds lying in sheltered basins, and other artificial ponds which are used for flowing the bogs.

This country no doubt was once well wooded. Then white pine woods extended well down on the Cape, and oak timber grew there; but, for years past, parts of this region have been visited by forest fires, until much of the wild land down through Sandwich, Barnstable and Falmouth has been burned over. Large tracts are now denuded of trees. On these tracts scrub oaks, pitch pines and berry bushes spring up. When these are burned, the ashes from the fire supply the earth with sufficient potash to produce a great crop of berries. Large tracts of this burned land are covered mainly with berry bushes; hence the saying that "the Cape is one great berry pasture." The low or dwarf species clothe the hills, while in the lower valleys and swamps the higher berries grow to perfection. Here birds find an abundance of fruit during the summer and early fall months. The swamps furnish them sheltered roosting places. The ponds and bogs furnish food and resting places for wild fowl and marsh birds.[1] The dead wood is an attraction for woodpeckers, and the wood birds find a congenial habitat in those portions of the standing timber still spared by the flames. Most of the country for miles to the north is of

[1] Since 1902 many of the swamps have been made into cranberry bogs.

this character. To the west toward Rochester the land is divided into farms, consisting of cultivated land, grass land and woodland, such as may be seen generally throughout eastern Massachusetts.

Now, let us look at the condition of the farm itself, when acquired, that we may consider its unaided capacity for attracting and sustaining a variety of bird life. The owner having left the place, it had been occupied for some years by tenants. This occupation had not conduced to its improvement, inasmuch as some land that might have been tilled had been left to the processes of nature, and had grown weeds, shrubbery and young trees. Such tangles, however much they interfere with good farming, seldom fail to hold out some attraction to birds, and for this reason they may be allowed to remain, wherever it can be done consistently with the purpose of the utilitarian.

As there were less than nine acres of land cleared, it was in the owner's power largely and immediately to control the conditions necessary to accommodate a change or increase of bird life, for trees can be cut much quicker than they can be grown. One cannot expect to have many species of useful birds about his farmstead unless he has, or can provide, in addition to his open or cultivated fields, a variety of trees and shrubbery. These will furnish birds food and shelter, roosting and nesting places, and retreats to which they may fly when pursued by their enemies of the air. Most land birds prefer the neighborhood of trees, and many species will not inhabit a treeless locality, for some nest almost altogether in the woods. Most birds prefer a well-watered locality. Water is furnished to the farm and adjacent land by several springs and small streams flowing to the river.

The kitchen garden, where most of the observations hereinafter recorded were made, is situated in the rear of the farmhouse, and is devoted to the cultivation of vegetables and small fruits. The soil, vegetation and management of the land immediately about it vary greatly. To the west are, first, a few orchard trees; next, a line of evergreens for a wind-break; and beyond these about seventy-five acres of open fields and meadows, where meadowlarks and other native ground-breed-

ing birds resort. The lower portions of the meadows nearest the river are frequented by blackbirds. Along the bushy borders of the higher fields birds of both upland and lowland mingle. Here the quails and pheasants lead their tender broods, always alert to guard them from the low-flying marsh hawk or the sneaking fox.

North of the garden the lowland is grown up mainly with birch and maple, hedged about with a thicket of shrubbery in which are mingled alders, berry bushes and fruiting vines. This tract is largely covered with thick undergrowth, where the trees are scattering. It is backed to the east by a few tall, lone pines, beyond which lies a high, sandy, open field, and then a small orchard. To the north it is bounded by a small cranberry bog, and beyond this a sandy knoll rises to the road. This low-lying open woodland, with its rich soil, dense undergrowth and tangle of vines, furnishes a good wind-break for the garden, shutting off the cold northwest winds. It also provides a sheltered, sunny retreat for birds in the piercing cold, but usually pleasant, winter weather when these winds are very searching on the open fields. Such a retreat is equally grateful to birds on cold days in spring and fall; and it forms an admirable breeding place for thrushes, robins, vireos, towhees, song sparrows, and warblers.

East of the garden the ground rises gradually, the soil changing from a bluish-black to a dark brown, then from brown to yellow, until, as we reach the hilltop, we find what was undoubtedly once a sand dune, like those of Cape Cod or Cape Ann. Here the only soil is almost a pure sand, and little grows but poverty grass and other primitive plants. Most of this rise is covered with a rather thin growth of pitch pines and white pines, but a thick belt of trees on the north gives additional protection to the garden and the poultry houses. Fowls do well here, for the exposure is sunny and the soil sandy. In the scrub oaks along the hillside, towhees, brown thrashers and cuckoos thrive. Here the notes of the pine warbler, wood pewee and field sparrow are heard in spring. East of this wood an open field with scattering trees leads to a neighbor's house on the hilltop.

South of garden, house and barn lies the "robin roost," a

grove of white pines, about forty-five years old and some three acres in extent. Here the robins roost in numbers in early spring, late summer and early fall, when they come in at dusk by hundreds. This is a breeding ground for jays, robins and squirrels. Green herons often roost here. Warblers, kinglets, titmice or creepers may be found in this grove almost any day during the entire year. For most of the season the grove is left to the birds, except for a part of each summer, when two summer cottages within its confines are occupied. There is a spring-fed pool in this grove, where water lilies, fish, frogs and turtles form a combination which seems to attract both feathered and unfeathered bipeds. This pool provides a bathing and drinking place for the birds of the grove. Here herons and kingfishers stop to fish. Here hawks stoop and wild fowl occasionally rest. In 1903 a family of wood ducks often came here. South of the grove is a field of three acres, devoted now to the cultivation of sweet corn, roots and other vegetables. This field is also surrounded by woods on three sides, with a belt of trees and shrubbery for a wind-break on the fourth or west side. This wind-break separates the field from a tract of lowland of some fifteen or twenty acres, once mainly salt marsh, but now, diked off and reclaimed from the river, it forms a cranberry bog. A pool of an acre or more lies in the centre of the bog. This was formerly an arm of the river called the "toad hole," and often swarmed with fish. It is still a breeding place for toads, and also a resort for herons, bitterns or shore birds in their seasons. Swamp sparrows, sharp-tailed finches and rails frequent its marshy borders.

I have been thus particular in describing the surroundings of the farm, because its fitness for attracting a variety of birds seems to be almost ideal.

In studying orchard birds, we learned that orchards surrounded in part by woods and in part by open fields were more frequented by birds, and therefore better protected against injurious insects, than were those surrounded by fields alone. The assumption that a garden similarly situated would also receive a like measure of protection was perhaps warranted. On such an assumption the selection of the location for a garden was partially based. Our first task was to attract

as many birds as possible to the garden. No attempt will be made now to give a list of the different species of birds found in the locality. Were such a list given from the experience of only two years, it would be merely provisional. Most of the birds common to the farms of Massachusetts are found here; a few exceptions will be noted later.

As the place was not acquired until July, 1900, all that could be done that season was to attract the fall and winter birds to the farm yard and garden. When the frosts came, suitable food materials, attached to the trees and scattered upon the ground or snow, caused a gathering of the birds from far and near.

The larger part of the birds remaining with us during the winter belong to the sparrow family, and are all seed eaters. Most of them feed their young largely upon insects, but breed far to the north, mainly beyond the limits of agricultural regions, so that during the breeding season their value to man as insect eaters is not great. As fall approaches, and frosts drive to their winter hiding places the insects on which these birds feed in spring or summer, the sparrows begin to feed on the now ripened seeds of wild grasses and other plants which sparrows are especially fitted by nature to destroy. At this time our native sparrows, the song sparrow, chipping sparrow, field sparrow and others, which have been feeding largely for some time on the seeds of weeds and grasses, begin their southward migration, and the northern sparrows come in to take their place. The white-throated sparrow is among the first to appear, followed closely by the fox sparrow, the junco (or black snow bird), and last of all the tree sparrow. Still later, when heavy snows fall, one may see the snowflake, also called the snow bunting or white snow bird, to distinguish it from the black snow bird or junco. The fox sparrow lingers awhile, and follows the whitethroat south; but the junco and the tree sparrow remain all winter, or so long as they can find food. A few song sparrows also linger through the winter. Now, if you watch these birds during the fall and winter months, you will find them feeding almost constantly on the seeds of weeds and wild grasses. They visit neglected cornfields and potato fields, roadsides, gardens and old fields grown up to weeds

where they literally cram themselves with the seeds, and put on fat rapidly. These birds are so full of seeds in the fall or winter that often if one is shot, held up by the feet and shaken, the seeds will flow from its mouth. These seeds are almost never passed whole through the alimentary canal of the bird and left to germinate when dropped in the excreta; but they are first hulled by the beak and then ground up by the tough, gizzard-like stomach, and their nutritious parts are thoroughly digested.

The goldfinch, which remains with us throughout the winter, is often seen clinging to the tops of the weeds, taking the seeds directly from the plant. More or less of this kind of work is done by redpolls, siskins and crossbills. The tree sparrows also feed largely by alighting on the plants and pecking off the seeds. The juncos and song sparrows take more of the seeds from the ground after they have fallen. These birds and the fox sparrows also scratch away the fallen leaves or grasses to get at seeds buried beneath them.

Where native sparrows are numerous in the fall, winter and early spring, they destroy nearly all the weed seeds to be found. This is well shown by Dr. Judd, in his admirable report on the relation of sparrows to agriculture. On a Maryland farm in 1896 he found sparrows swarming during the month of December. In a tangle of smartweed the ground was literally black with seeds which had been cracked open by the birds and the meat removed. In a rectangular space eighteen inches square were found 1,130 such remains of seeds and only 2 whole seeds. The birds fed in the locality well into May, and *no smartweed grew the ensuing year where the birds had caused this extensive destruction.*[1]

Prof. F. E. L. Beal, who has perhaps made as extensive studies of the food of birds as any one now living, estimates that the tree sparrows in the State of Iowa eat 875 tons of weed seed each winter, and he allows only 10 birds to the square mile.[2]

Good farmers are supposed to grow no weeds; but any one travelling through Massachusetts in August or September

[1] Bulletin No. 15, Division Biological Survey, United States Department of Agriculture, p. 28.

[2] Farmers' Bulletin No. 54, United States Department of Agriculture, p. 28 (1897).

may be surprised, perhaps, to see that most farmers grow them abundantly. Most of the fields where corn, potatoes and other crops have been grown are so covered with weeds at that season that in many places it is difficult to see the crop from a distance. No doubt these rank growths are a compliment to the soil, but they are no compliment to the cultivation. The fields of Massachusetts are not alone in this condition. Let the farmers of other States speak for themselves. In truth, there are more weed seeds for the birds than birds to take care of them. Where the hay fields and meadows are closely and often cropped, fewer weeds have a chance to mature their seed; but even there some low-growing plants are left, which survive the cutting, and weeds come in. Where weeds are allowed to grow unhindered all through the fall months, birds cannot be expected to destroy them all.

In our garden we attempted to keep the weeds in subjection. This in 1900 was almost an impossibility. In 1901 it was a serious task, and necessitated frequent weeding or hoeing all summer and into the fall. In 1902 the labor was much lightened, and this was in part due to the birds. All farmers know that, while hoed crops in the main may be kept nearly free from weeds, it is impossible to weed a squash or melon patch without injuring the plants. Such crops invariably foul the land. It is also very difficult to keep all fences and borders of fields clear of weeds. We depended mainly on the birds to take care of such weed seeds as were left in the squash or melon patch or along the borders, and they did their work well.

The first year, birds were not numerous enough to destroy all the weed seed; the second year, there was hardly enough seed to gather an increased number of birds. A small patch of Japanese barnyard grass was planted north of the garden. The seed of this millet proved very attractive to birds, but it was not molested except by goldfinches and an occasional English sparrow until the seed began to fall. The millet was then reaped and the seed saved, but not until a great quantity of it had fallen to the ground.

All the fall and winter this seed proved a great attraction to the birds. Sparrows were almost constantly feeding in the vicinity, and the seed seemed to be relished by all of them.

There were probably some bushels of this seed on the ground in the fall, but by spring hardly one could be found, and only a very few scattering plants grew there the following spring. This plant is merely a cultivated variety of a common wild grass or weed, hence its attractiveness to birds.

Juncos and tree sparrows came in greatest numbers. They not only destroyed the millet seed, but they also found and ate practically all of the weed seeds remaining. The sparrows eat, usually with avidity, the seed of many of the worst weeds known. Dr. Judd mentions the following weeds which are troublesome in fields and hoed crops, and which are eaten by some twenty species of sparrows: ragweed; several species of the genus Polygonum, including bindweed; smartweed and knotweed; pigweed; nutgrass and other sedges; crab-grass; pigeon-grass; lamb's-quarters; and chickweed.

Chickweed, ragweed, smartweed and purslane are among the weeds whose seeds have been freely eaten by sparrows in our garden. Purslane is so tenacious of life that branches cut off by the hoe and thrown on the soil will at times take root and grow lustily. Chickweed is particularly prolific, because of its deceptive habit of blossoming and developing seed at the same time. In all these weeds the farmer will recognize foes worthy of his steel. Some of the sparrows are also particularly useful as insect destroyers, as we shall see later.

While speaking of sparrows, lest error be promulgated, it should be definitely stated that the house sparrow or English sparrow cannot be included in the list of birds beneficial to the garden. This bird feeds on grain to the amount of more than two-thirds of all its food; is destructive to peas and other garden vegetables, as well as fruit; and destroys comparatively few insects. It eats perhaps less than half as many weed seeds as any of our common native sparrows, and makes itself generally so disagreeable as to prevent many other birds from breeding in the neighborhood it inhabits.

Our work, in conjunction with that of the birds, had been so efficient in exterminating the weeds that during the winter of 1901–02 it frequently was necessary to scatter chaff and hayseed from the barn floor around the dooryard, to provide

sufficient food for the birds. In severe winter weather the scratching sheds connected with the poultry houses always furnished them a place of refuge. These sheds open toward the south (which side is covered with poultry netting), but are closed on all other sides. The ground in these sheds is somewhat deeply covered with litter, in which wheat screenings and small grain are scattered, to give the hens exercise in scratching it out during the day. The fowls are not admitted to these sheds very early on cold or stormy mornings. Two sheds having no curtains, the sparrows invariably occupy them at such times, even if they do not remain through the night. They are protected from hawks and cats by the netting, and they busy themselves in searching and scratching among the litter for weed seeds and the small particles of grain overlooked by the fowls.

Here and in two open sheds at the barn the winter sparrows can always find food and shelter. The woods and shrubbery around the garden offer the sparrows a refuge to which they can retreat at the least sign of danger. This is an advantage which not all gardens possess. The song sparrow and the junco do not like to go far afield, if they can secure food, as in this case, near cover. The snowflake, on the contrary, seems to prefer open fields and pastures, trusting perhaps to its protective coloring or to its skill in flight, for it rarely stops in the vicinity of the garden.

During the first winter some little attention had been paid to methods for attracting the insect-feeding winter birds. Animal food, such as bones, suet and dried meat, was hung upon the fruit trees, and attracted some attention from chickadees, jays, nuthatches and woodpeckers. These and the sparrows formed a merry company, which served to attract other birds, so that before the end of the winter most of the commoner land birds found at that season frequented the place. The effects of their presence was noticeable in the scarcity of injurious insects in the spring. The next problem in the sequence of the seasons was to induce members of the spring flight of birds to remain with us to breed. To this end it became necessary to increase the inducements to nest building, and offer material for bird homes.

As spring opened, the place was looked over to see what nesting sites were available to those birds that prefer to breed in hollow trees. There were practically none. The recent tenant on the place had been allowed to use for fuel such dead wood as he could find. He had availed himself of his opportunities, until hardly a dead tree remained. Having continued this practice for the past two years, I am led to believe that usually it is bad policy. It has resulted in a scarcity of the smaller woodpeckers, which ordinarily hold destructive bark beetles and other wood-boring insects in check. As a probable effect of this scarcity of these useful birds, the *Scolytidæ* and some of the larger borers are now beginning to injure the living trees. The practice of cutting out dead timber also removes the breeding places for wrens, swallows, bluebirds, screech owls, chickadees and other useful birds. No bluebirds, swallows or wrens were found breeding on the place. The screech owls and flickers were driven to take refuge in the summer cottages. It was evident that an attempt should be made to bring back such birds as would accept artificial substitutes for their natural breeding places in trees.

Early in March, 1901, a number of bird boxes were put up on the trees about the borders of the woods. These were purposely made of old, weather-beaten lumber, and were inexpensive, four of the shingles removed when shingling the barn and a bottom and top piece of boards completing each box, as shown in Fig. 1. Bird boxes put up in this locality should face to the south or west. If placed thus and on the south or west side of a building or tree trunk, they are not so much exposed to the cold storms which so often occur in early spring; but they should be put in shady situations. The hole should be placed near the top, and for a wren should not be over seven-eighths of an inch in diameter (Fig. 2), and the one and one-half-inch size will do for the bluebirds and tree swallows. The seven-eighths-inch hole will certainly exclude English sparrows from wren boxes, and, if there is no perch connected with the box, it will be diffi-

Fig. 1. — Shingle Box.

tially decayed birch stumps by simply boring a one and one-fourth-inch auger hole into the side of the stump, at a point some distance from the ground. The birds, finding a hole already begun, will finish it and build a nest there, as they do sometimes in the excavations made by woodpeckers. Believing that these birds might take advantage of a nesting box if it were provided for them, we first cut away all the dead stumps within a radius of about two hundred yards of the house and garden. Then food was put out in the winter on branches fastened to the house. A small pine tree was placed near the kitchen window and another at the dining room window, and these were hung with bits of meat, bone and suet. The chickadees and other birds soon found them, and came to them regularly day after day and hour after hour, continuing their Christmas festivities all winter and well into the early spring. A single bird box was then put up at a window in a loft over the woodshed. This was made after a pattern I began using thirty years ago, and may be called an observation box (Fig. 3). As shown in Fig 4, it is provided with a door, which consists of a hinged side facing the window, and which can be opened at will by the observer. A pane of glass is also inserted in this side, so that, when the door is opened, the eggs or nestlings are protected by the thick glass from dangers without. Such a box must be so placed that the sun cannot shine into it, as this might endanger the lives of the young birds. Before this time the English sparrows had been all shot, or driven away from the premises, the mice and squirrels had been ejected from the bird boxes, and the chickadees began to manifest some curiosity as to the purpose of these

Fig. 3. — Observation Box closed.

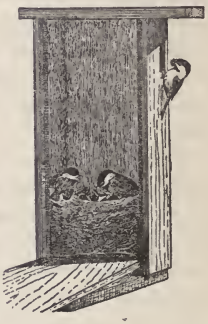

Fig. 4. — Observation Box open.

curious habitations. As spring approached, a chickadee was seen now and then to enter one of the boxes. The one over the woodshed was inspected frequently, and it is believed that toward spring one or more of the birds passed the night in its shelter.

When spring opened and most of our little friends retired to the woods, one pair remained behind and made their home in the observation box. Another pair set up housekeeping in a birch stump not far away in the edge of the pine grove. The pair in the box, having abundant nesting material at hand, soon began building. Here was an excellent opportunity for watching the construction of the nest, but the box was not opened or disturbed, for fear that the birds might forsake it.

All in the house were enjoined to keep away from the box until the birds were seen carrying food to the nest. The box was then opened, and seven young birds were found. From this time on the feeding and growth of the young birds were observed through the glass. Mr. C. A. Reed, the editor of "American Ornithology," became interested in this young family; and on June 10, having been notified that the birds were ready to leave the nest, he came with his camera to photograph them. The old birds had now become so accustomed to our presence that they would come and feed the young while people were at the open window within a foot or two of the box. When sitting at the window, one could see plainly the insects held in the beaks of the parent birds. Large insects were brought singly, smaller ones in bunches or masses, — one might say almost in mouthfuls.

The old bird gathered ants, plant lice, spiders, etc., in its bill until that was well filled, when it flew quickly to the box, fed the young, cleaned the nest, and, taking the excrement in its bill, flew away for more food. Sometimes the most greedy youngster got the whole mouthful; at other times the food was divided among the young. The following notes, taken at the nest while the camera was in position, June 10, will show how little the birds were disturbed by our presence, and how often they came with food that forenoon. The box was opened and the camera set up at 9.50 o'clock. At 9.52, the female chickadee came with a large, dark caterpillar. At 9.54, the

cult for the sparrows to drive the wrens away. The hole always should be small enough to keep out blue jays, gray squirrels and owls. The openings to the boxes put up in 1901 were too large, and, although many birds came to them, they were so annoyed by their many enemies that only one pair of bluebirds succeeded in raising a brood, no other birds occupying the boxes. Two pairs of English sparrows began operations, but were not allowed to proceed.

Fig. 2.—Sparrow-proof Box.

Nesting materials were scattered about and hung from the branches of the trees, so that bluebirds, wrens and swallows might have unlimited material at hand. This was continued in the spring of 1902, but only three broods of bluebirds, two of which were raised, were hatched in these boxes. No swallows, martins or wrens succeeded in occupying any of the boxes. The experiments in this direction have resulted in a partial failure, mainly through the abundance of the birds' enemies. In respect to the chickadee, however, this experiment has given results which will compensate in a large measure for its failure in other directions. Studies of the food of the chickadee have convinced me that it is perhaps the most useful of all birds in the orchard, and as valuable as any in the forest or woodland. This bird destroys vast numbers of such orchard pests as the cankerworms and other soft caterpillars, taking also the hibernating forms of these insects, whether eggs, larvæ or pupæ, in great quantity. It also destroys the eggs of the forest caterpillar moth and those of the common tent caterpillar to some extent, killing large numbers of the caterpillars of both these insects, as well as those of the gypsy moth, the brown-tail moth and other hairy caterpillars. It is a great feeder on the plant lice, and the bark beetles are also eaten by it. These insect families contain some of our worst tree pests. Chickadees are continually searching over the bark of the trunks, limbs and twigs of trees. In this occupation they find and destroy the eggs of moths and plant lice, the cocoons of the codling moths,

case bearers, leaf miners and many injurious minute insects. They also open decaying twigs infested by borers, removing them with certainty, though with less skill than the woodpeckers exhibit. Nor is their work confined wholly to the trees and shrubbery, for in the early spring, when the snow has gone and the warm sun begins to cause the first stir of life among hibernating insects hidden in the forest floor, the chickadees descend to the ground, where they search among the leaves, extracting worms from decaying chestnuts or acorns which have been overlooked by jays and squirrels, or digging out pupæ which have either hibernated among the leaves on the ground or fallen with them from the trees. Such insect food as given above forms the main part of this bird's sustenance, nor has it any bad habits, so far as known. When driven by extremity, it may eat a few bits from worthless apples frozen upon the trees, or pick up a few fragments of corn or oats by the roadside or in barnyard or poultry yard; but apparently it prefers, in such cases, the berries of the sumach, and never injures cultivated fruit or grain of any value. It has none of the bad habits of some of its European relatives. Its nesting habits and its confiding nature led to the belief that it might be so domesticated as to become as attached to our homes, in time, as the English sparrow is to-day. What a benefit might have been conferred on our city parks, had we induced these birds to breed there, instead of importing the redoubtable sparrow.

European titmice breed quite freely in boxes put up for them, and their numbers can be increased readily under man's protection. The American crested titmouse is said to breed occasionally about human habitations; but the chickadee, our most common titmouse, has mainly held aloof from human dwellings during the breeding season.

Thirty years ago, before the English sparrows became plentiful, this bird bred in the hollow trunks of old apple trees in orchards or dooryards, and does so to-day where the sparrows have not obtained a foothold; but it has been driven from such localities by the sparrow, returning to its old haunts mainly in the winter, when sparrows resort much to the city or village streets. Chickadees may be induced at times to build in par-

male bird came with a light, geometrid caterpillar. At 9.57½, the male bird brought two caterpillars. At 9.57½, the female brought one large, green caterpillar. At 10.02, the male brought a pupa about like the codling moth. At 10.07, the male brought a grasshopper with legs trimmed off.

While the male was there the female came also with a bunch of spiders' eggs, and, following the male, fed immediately. We then removed the glass, and, reaching out, pushed down the side of the nest so that an attempt could be made to photograph the young, which were sunk down in the nest quite out of sight from the camera. At this the young made a noise which sounded much like the loud hissing of a snake, but proved to be an attempt of all seven at once to scold in chickadee language.

This disturbed the old birds, who showed some anxiety, and did not feed again until, at 10.14, the female brought a green caterpillar; at 10.17 a heavy team went by, but the male came again, at 10.19, with a large caterpillar, and again at 10.22 with smaller caterpillars. At this time the largest and most active young bird, which had been quite restless and several times had attempted to reach the entrance hole, made a dash, and flew, at the first attempt, to a maple tree near by; but failing to alight there, it fluttered on to a stone heap at the foot of a pine tree some four rods away. In this remarkable feat it no doubt was aided by the strong breeze then blowing. This bird was later captured and returned to the box, but refused to remain, and the second time flew to a pine tree several rods farther off, reaching it in two flights. This diversion somewhat interrupted the regularity of the feeding, as the old birds devoted most of their attention to the young truant. The female came to the nest once at 10.23 with ants, plant lice and a spider, and the male came directly afterward with similar food. At 10.24 the female came again, and at 10.24½ the male came; at 10.28¼, the female; at 10.34, the male. At this time the food, which came in large mouthfuls, consisted mainly of ants and plant lice. At 10.36, as I leaned from the window to put in the glass, the mother bird came with her beak full of insect food and alighted at the entrance hole. At this time one hand held the glass, while the other rested on the box. The bird clung to the side of the box, re-

garding me at first with some suspicion, but soon went in and fed the young a large, green caterpillar which she had brought. While I kept this position both birds came again, the female going in at once and feeding the young as before; but the male alighted on top of the box, scanning my face with his bright dark eyes for some time before he would trust himself to enter. The young were evidently fully fledged and ready to fly. Two of them had flown already and had been returned to the box. The parent birds stopped feeding them and began to call. They were answered by the young. At this moment the old birds flew, one to the box and the other to the edge of the roof overhead, while the young all sprang out in quick succession, all but two of them alighting on my arms, head or shoulders, much to the delight of the children, who were watching from below. The old birds came to me and piloted the young to the branches of a pear tree near by. This happy family remained about the vicinity for some time, and probably still forms a part of one of the flocks of chickadees now in the neighborhood.

This account is given with all its details to show how readily the chickadee will accept our hospitality, and how valuable an acquisition it would be to the birds which nest about the farm buildings. It is hoped that others may be led to experiment with it in the same way. This family of chickadees and a family of bluebirds, that was raised in a box on the apple tree near by, kept the fruit and shade trees near the house quite free from injurious insects. A nest of the tent caterpillar which appeared on the apple tree where the bluebirds built their nest was rifled of its contents. Two young apple trees that swarmed with plant lice were almost entirely cleared, and suffered no injury from the lice; while two on the hill beyond the garden, where the chickadees did not go, suffered much from these pests, and finally died. With eleven hungry nestlings to be fed, the few cankerworms hatched from the eggs overlooked by the birds were soon disposed of.

Now, let us return to the garden. The care of a garden seldom fails to banish sleep in the morning. The least sound is sufficient to arouse you. At a light, intermittent pattering sound on the roof you are awake at once. It is only a gray

squirrel running over the roof. As you rise to prepare for the duties of the day, it is hardly light enough clearly to distinguish objects in the grove. From the wooded brookside the sweet and solemn tones of the wood thrush float tremulously to your ear. Now a robin sings boldly from the top of a tall tree, where he can see the promise of day in the east; another takes up the refrain, and, by the time you have reached the garden, the full bird chorus pours forth from the surrounding woods. Mingled with the refrain you hear the distant trill of the chipping sparrow rising and falling like the breath of a sleeper in the fields. The oven-bird awakens the echoes of the woods with a *staccato* note. The light, cool breath of the morning fans your cheek as it comes up from dewy meadows laden with the fragrance of lilies and azaleas. The eastern sky is rosy with the dawn, and as you gaze upon the beauteous scene dark shadows fade and fly. Aurora climbs the glowing firmament and morning walks abroad upon the fields. With a heart filled with thankfulness you slowly sink on bended knee and *go to killing squash bugs*, — otherwise, you would get few squashes. Much as the farmer may admire the beautiful in nature, he cannot spend the early morning hours in idle contemplation.

As you look abroad over the garden, you see robins hopping here and there, searching for earthworms, cutworms and grubs. Robins find many earthworms early in the season, but later, as the soil loses much of its moisture, these worms cannot be found so readily, as they descend to greater depths, and the robin must depend largely on insect food for its own subsistence and nourishment for its brood. Owing to the abundance of the robin in our neighborhood, it easily led all other birds as a destroyer of garden pests. It is one of the few birds that habitually seek their food on the ground in the garden early and late when the cutworms are abroad. The abundance of robins in the vicinity may be accounted for in part by their fondness for their roost in the pine grove. In 1901 there were more than thirty robins' nests in trees in the woods or fields near the house. There were three in a large pine in front of the house, and three more over the door of a summer cottage near by. Although most of the eggs or young in the nests were destroyed by the various enemies of birds, there were usually

FIG. 5. — The Robin on her Nest. (Copyright by C. A. Reed.)

from three to six young robins about the garden most of the summer, and in May, June and July there were many adult birds. No sooner would any one go into the garden with plow, harrow, cultivator, hoe, fork or spade, to stir the earth for any purpose, than the robins would follow, picking up grubs, wireworms, earth worms, cutworms and ground beetles. There were few insects they would not eat. They soon became so tame that they would approach within a few feet of the worker, and if grubs or worms were tossed to them they would come and pick them up from the ground.

White grubs, as most of you know, are the larvæ of May beetles of different species, and destroy the roots of growing plants. They are serious pests in grass land or among hoed crops. If numerous, they will soon ruin a strawberry bed or a grass field, and because of their habits of burrowing in the ground they are hard to control. Wireworms, which are the larvæ of click beetles, also live under ground, and destroy the roots of plants, in some cases burrowing up the stems. They are destructive to turnips and other root crops, as well as to cabbage, celery and many vegetables, and must greatly reduce the productiveness of grass lands.

Cutworms are larvæ of *Noctuid* moths, and probably do as much injury both annually and periodically as any pest known. They not only eat the foliage of many plants, but they cut off the stems of young vegetables close to the ground, destroying the crop. As they feed mainly at night and hide underground or under some shelter during the day, they are seldom noticed until the damage is done. Ground beetles are usually classed as useful insects; but, as many of the species feed quite largely on vegetable matter, their usefulness no doubt depends to some extent on their being kept within proper bounds. Several genera have been known, where numerous, to destroy grass, weeds, grain or fruit. Some of them, notably of the genus *Harpalus*, are becoming widely known as destroyers of the fruit of the strawberry. Members of this genus were found eating the seeds of the Japanese barnyard millet along the borders of our garden. The robin constitutes a natural check on the increase of these creatures, which, if held in their place, are no doubt beneficial, but, if allowed to become too numerous

to subsist on their natural food supply, will destroy cultivated crops.

The skunk has the reputation of being the most efficient enemy of the white grub; but here, where both skunks and robins were searching for food, the robin's work was the more effective. The onion and carrot beds were regular breeding grounds of these grubs. The hand cultivator was run frequently between the rows, and robins ran after it. In fact, the robins cultivated those rows more assiduously than did the cultivator. They picked up the insects that were turned up by the cultivator; they dug conical holes around the plants, almost always unearthing a grub at the bottom of each hole. This work they persistently followed up, day after day and week after week. So persistent were they that very few of the roots were found injured at harvest time by either grubs or wireworms. Probably some credit for this result must be given to the moles, that occasionally burrowed beneath the plants along whole rows, and undoubtedly secured some of these grubs which the robins failed to reach. Throughout the season the robins were watched as they fed their young, and it was seen that they habitually fed grubs, cutworms and many of the most injurious caterpillars. The larvæ of large insects seemed rather to be preferred, and a robin, when going to the nest, often took several insects at each trip.

While spading a small plot in the garden one day, I watched a robin that came to feed. She picked up a large white grub that had just been turned up by the spade, laid it out upon the unspaded ground, dug out another, laid it beside the first, and after hopping some distance secured still another large one, which she took to the spot where the first two still lay. After several ineffectual efforts, she succeeded in getting a firm hold on all three, when she flew at once to her nest near by, fed them to her young and came back for more. The whole proceeding did not occupy five minutes. These grubs were dug out by the robins wherever they could be found. They took them from compost heaps, from beneath the mulch about the fruit trees, and seemed to know, as if by instinct, just where to find them. It should not be inferred, however, that they found these grubs by instinct. Their skill in finding them was

acquired, and no doubt was entirely a matter of early education and experience, except in so far as their keen faculties of observation were transmitted to them by their parents. The young robins, when they first left the nest, were nearly helpless so far as finding food was concerned, and it was some weeks before they had learned to find grubs with certainty. At first they were fed almost entirely by the parents; later, they learned to pick up objects from the ground and to pursue crawling insects; but they did not acquire, during their first summer, the skill evinced by their parents in digging out grubs. An adult bird, when once it began to dig, seldom missed the worm or grub. The young birds frequently failed to secure their prey, and were fed more or less by the old birds for some weeks after leaving the nest.

The first season (1901) we set out a few rows of strawberry plants of different varieties. Perhaps it is needless to add that the robins got nearly all the fruit. This created, as it usually does, a rather unreasonable prejudice against the birds. In this the whole family shared; but, had the robins been killed then, there is little doubt that our strawberry beds would have been ruined in 1902. A close watch was kept on the robins in the strawberry bed in 1901, and they were seen to devour, on the average, five insects to each strawberry. These insects were nearly all such as were injurious to strawberry plants, and were taken either from the plants they were feeding on or from the ground beneath. When in 1902 the number of strawberry rows was much increased, the injury done by robins to the fruit was proportionately very small; and a new bed, planted on the ground originally swarming with white grubs, did very well. The robins so nearly exterminated the grubs that but few plants were lost.

The robins occasionally took a raspberry or currant. They also took insects from the currant bushes (presumably currant worms). Their heaviest toll of fruit was taken from the cherry trees. In some localities their attacks on the cherries have been prevented by growing the Russian mulberry, — a fruit they often prefer to the cherry; but this is not always a certain remedy, and it is safer to plant cherry trees enough to supply both the birds and the family. Much space is given here to

the robin, because with us it has proved to be the most useful bird in the garden. The food of the robin has been studied, within the past fifty years, by many investigators. Their conclusions, however, have not always agreed.

Prof. J. W. P. Jenks, Mr. E. A. Samuels, Prof. S. A. Forbes, Mr. F. H. King, Prof. F. E. L. Beal and some others, while varying in their estimates of the robin's value, all regard it as a useful bird; but the investigations of Mr. E. V. Wilcox and Prof. F. S. Webster, published in Bulletin No. 43 of the Ohio Agricultural Experiment Station, present results rather unfavorable to the robin. It is not my intention here to take issue with these gentlemen as to the facts stated in their writings on this subject. I wish merely to call attention to some errors into which investigators who are not familiar with birds' habits are likely to fall, and also to show wherein the observations of Mr. Wilcox do not agree with my own.

He has stated to me in conversation that most of the robins whose stomachs were examined were shot while feeding on the grounds of the experiment station, and mainly during the busy hours of the day. Few birds were shot very early in the morning or towards dusk. Now, the robin is very active at such times, and it is then that it has the best opportunity to secure the cutworms, the percentage of which in the stomachs of those examined by Mr. Wilcox is probably too small. All vestiges of cutworms eaten by the robin at 3 to 4 A.M. will probably have disappeared from the stomach at 6, by reason of the bird's rapid digestion. Most of the robins were shot on the station grounds at a time when they were feeding largely on the small fruits grown there in profusion. Naturally, a larger proportion of cultivated fruit was found in the stomachs than would have been the case had a larger number of the birds examined been shot in other localities and at other times. This seems hardly fair to the species. No stomachs of nestling robins were examined. This seems a capital omission. In our investigations nestlings have appeared to require a very large proportion of insect food, and as they increase in size they require more food than the old birds. A young robin has been known to eat forty-one per cent more than its own weight each day.

Mr. Wilcox failed to find any grubs in the stomachs of robins

shot on ground recently plowed, and he accounts for this by the statement that the robin does not follow the plow as closely as does the crow blackbird, and that the grubs soon bury themselves in the soil, "hence the failure of the robin to find any." This is entirely contrary to our experience here. We have found the robin to be a much more effective destroyer of the white grub than the crow blackbird, which will wait for the robin to find and dig up grubs, and then quickly snatch them away from its beak. If we were to rely on stomach examinations only, the blackbird might get more credit for finding grubs in the ground than he deserves. Our experience in Massachusetts is corroborated by that of Dr. Roberts of Minneapolis, who finds the robins there much more expert in digging out grubs from lawns than is the crow blackbird.

Mr. Wilcox says that he has never seen the robin searching for insect food except upon the ground. In Massachusetts, how-

Fig. 6. — Robin with White Grub for her Young.

ever, the robin occasionally takes caterpillars from the trees. It is quite probable that twenty observers scattered over the county in which Mr. Wilcox made this investigation would have made more or less contradictory reports. It is unsafe to generalize too much from observations made by one man in a single

locality. My observations on the robin are offered with the belief that the statements made are correct so far as my own garden is concerned. A small fruit grower differently situated might consider the robin an enemy. The picture of the robin at the nest with a grub in her bill shows the eagerness with which the young robins anticipate the coming of their food (Fig. 6).

Next to the robin in usefulness in our garden comes the chipping sparrow. This little bird, which often hops about the dooryard of the farmhouse, picking up crumbs that fall from the doorway, spends much of its time in the garden. With us it did no noticeable harm, feeding much on insects in the spring and summer, and largely on weed seeds in the fall. It was almost constantly busy along the vegetable rows in early summer. It was especially devoted to the green peas and the beets. Beets are usually more or less infested with a larva which mines the leaf, in some cases destroying many leaves. This insect is not usually a serious pest, as some enemy appears to check its undue increase. Early in the season the beets were attacked by it and were quite seriously infested, but as time went on the number of worms grew less and less. It was noticed that this scarcity of the beet worms was coincident with the appearance of the chipping sparrows among the plants, and that the longer the birds worked there the fewer beet worms could be found. These sparrows were commonly to be seen going up and down the rows, feeding among the plants in the garden where table beets were grown. Other birds of this species were also observed in the field among the stock beets or mangel wurtzels. I was enabled one day, by creeping along the ground between the rows, to get very close to a chipping sparrow which was feeding there. It was passing among the plants searching somewhat among the stems, from which it took small insects, but mainly getting its food from the infested leaves. By moving very cautiously, I was able to follow it for a hundred yards along the rows. It could be plainly seen taking something from the leaves. It touched none but the infested leaves. In each case when the bird had passed, the leaf was freshly punctured, and the worm was missing. The little bird found it necessary in many cases to use its wings to reach the

worm, but never failed to get it. Apparently eleven of these worms were secured in a few minutes, and several other small insects were taken. Having watched these birds through one long summer, I have little doubt that their presence saved the beet crop from a serious reduction.

The imported destructive pea louse was very prevalent in 1900, and we were prepared for its appearance in the spring of 1901. The lice appeared as expected, but failed to increase as heretofore. One morning one of the boys at work in the garden reported that chipping sparrows were eating the pea lice. This proved true, for all through the season and also the next season wherever peas were planted these birds appeared and fed on these plant lice persistently, day after day, so long as they could be found. A row of late peas about one hundred yards in length became infested in August. These peas were one-eighth of a mile from where the early peas were planted, and in a locality not ordinarily frequented by the chipping sparrow; but the birds soon found them, and haunted the vines day after day, until the lice were so reduced in numbers that they did no further injury. It seems probable that this habit of the "chippy" is widespread, for Mr. H. W. Olds and Dr. Judd have both observed it.[1]

These birds apparently rendered it unnecessary for us to protect our peas from these destructive aphides. How generally they may have effected such a result elsewhere I have no means of knowing. It is quite probable that they have borne a prominent part in reducing the pea louse from a pest of the first class to its present status. These birds fed on the eggs of the parsley butterfly, taking most of them from the leaves of the celery or parsnip plants, where they are deposited by the insect, usually one in a place. The chipping sparrow also feeds on the young larvæ. The attentions of the "chip birds" are not by any means confined to the garden. They are very useful in the orchard, particularly in the destruction of caterpillars, upon which their young are largely fed. They also feed in the borders of woodlands, along the roadsides and in the open fields. As these birds often raise two broods each season, and

[1] Bulletin No. 15, Division of Biological Survey, United States Department of Agriculture, p. 77.

their young are nourished almost entirely on insects, their great value to the farmer is unquestioned. In the illustration from Mr. Reed's photographs the parents are seen with their callow brood (Fig. 7). In the lower picture, the female, having brought a caterpillar too large to be fed whole, joins with the male in dividing it.

The song sparrow is another bird which has done excellent service in the garden. A pair of these birds nested near a ditch at the north side of the garden in 1901, where they confined their attentions principally to the early cabbage patch. Both cabbages and cauliflowers made a rank growth, and by June had so covered the ground that these creeping ground sparrows could readily pass beneath them unobserved. Their habits in this respect are such as to completely baffle the ordinary observer. Finally, after much watching, they were seen to eat the cabbage plant louse and some of the cabbage worms. This pair of birds could be found among the cabbages at almost any hour of the day. They sought their food there almost continually, and they made great havoc with the cabbage insects; but, as there were five different caterpillars on the cabbages, and the birds took much of their food when concealed from view or at a distance from the observer, it is hardly possible to say more than that probably all species were eaten.

All the cabbage insects were so reduced in number that little injury was done to the heads. No insecticides were used upon the cabbages or cauliflowers, though a few worms were killed by hand at first. They were afterward left to the sparrows. The chipping sparrows also took worms from the cabbages. The song sparrows eat most caterpillars if they are found in the immediate vicinity of their nests. With us they do not go far afield when they can find sufficient food near at hand. They seldom went beyond the cabbage patch, flying from that to the thicket about their home. They feed mainly on or near the ground, and for this reason, perhaps, they search out and destroy many cutworms. They were not seen to take any fruit from the garden, although they have been known to eat strawberries, blackberries and raspberries. This was the only pair of these birds nesting about the garden in in 1901. Their young were destroyed, probably by a cat, and

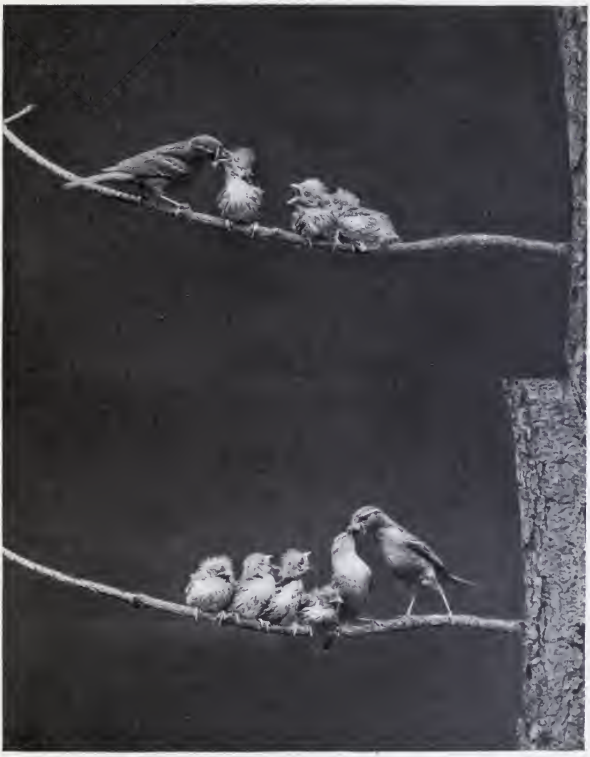

FIG. 7.—Chipping Sparrows feeding their Young. (Copyright by C. A. Reed.)

possibly the old birds suffered the same fate, as no song sparrows nested there in 1902.

Among the birds which frequented the garden were the catbird and the goldfinch; but, so far as could be seen, these birds contributed little to its welfare. The goldfinches attacked the millet in the field, the sunflowers along the garden border, and ate pieces from the leaves of lettuce and other tender vegetables. They were not seen to eat insects, but they are useful as destroyers of plant lice, caterpillars and other tree-feeding insects. They destroy weevils also; but, so far as could be observed, they were slightly detrimental to the garden. The catbird was never seen to enter the garden except as it went to the strawberry bed after the berries were ripe. Apparently the catbirds went to the garden for strawberries alone. They were never seen to eat anything else while there, and, as they were about the strawberry bed much of the time while the berries were ripe, they must have eaten as many berries as all the robins, for the robins only took strawberries occasionally. A pan of water was set out near the strawberry bed, that the catbirds might have an opportunity to allay their thirst before reaching the berries. They took no notice of this, as they evidently preferred strawberry juice. If driven away, they would return immediately. They remained about the bed until the berries had been picked, when they left at once, and hardly visited the garden at all for the rest of the summer. Were we to judge the catbird by this experience alone, we must agree with those who consider it a pest. Many people have had somewhat similar experience with it. My experience with it in Worcester, however, was somewhat of a contrast to this more recent acquaintance. There we raised strawberries with little trouble from the catbirds that nested near the garden, and were of considerable service in the destruction of insect pests, notably the white grub. This bird, however, is probably of much less service to the farmer than many others, and is not to be compared with the robin as a destroyer of garden insects.

The vireos, redstarts and warblers, which bred in the woods around the garden, occasionally came inside its limits, but confined their attention mainly to the insects on the fruit trees,

so that, so far as could be seen, their presence in the garden had little or no effect on the vegetables. These birds were much of the time engaged in killing caterpillars of many species. They were so assiduous in this that no serious injury was done by caterpillars to any of the trees near by. Even the wild cherry trees, which are ordinarily stripped by the tent caterpillar, were left intact. The vireos are probably among the most efficient caterpillar hunters. The illustration showing the red-eyed vireo feeding her young (Fig. 8) is introduced here to show how the parent bird inserts her bill into the throat of the newly hatched young, and thrusts the food down into the gullet. This may be a necessary precaution some days later, for the living caterpillars then fed sometimes crawl out of the mouths of the young birds, and escape.

Blackbirds, brown thrushes and towhees kept well away from the house the first season. Dogs, cats and boys evidently had made them distrustful of the neighborhood. A little grain scattered about, in the spring of 1902, brought several blackbirds and a pair of brown thrashers. The blackbirds soon became quite tame, and remained about the place until, late in May, they retired to the meadow to breed. The brown thrashers came to the dooryard all summer, in search of crumbs and fragments of grain, and finally became quite tame. Neither these birds nor the towhees seemed to be attracted to the garden, although the towhees came into it much during the late summer. These birds are all useful in the garden, provided they can be induced to frequent it. None of them injured anything in it, except that the towhees picked up a few ripe gooseberries. Some of the birds which are known to be conspicuously useful in the garden did not stay with us, although they were occasionally heard singing in the early spring.

Those who have followed me thus far may begin to surmise that for some reason birds were not exceptionally numerous in this locality, so well fitted for their homes; such indeed is the case, and the reason is not far to seek. Birds have been protected here to some extent for years, so far as the encroachments of the gunner are concerned, but their natural enemies have greatly increased in the mean time. All the swallows and most of the bluebirds have been driven away from the

FIG. 8. — Red-eyed Vireo feeding Young. (Copyright by C. A. Reed.)

neighborhood by the English sparrow. Most of the smaller birds which had survived the attacks of their various enemies failed to breed, for either the eggs or young were destroyed. No doubt this state of things ought sooner to have been remedied; but I desired first to study the influences which diminished the numbers of these useful creatures, so as to be quite certain what means to take for their protection.

My experience here during these two years, taken in conjunction with the experience of the previous twenty-five years, leads me to believe that the enemies of birds stand about in the following order, as regards their importance: cats, English sparrows, gunners and boys, crows, jays, hawks, squirrels, snakes, skunks, foxes, weasels and other small mammals. Owls, shrikes, and some other birds may be named also as of varying importance according to circumstances. Dogs eat eggs and kill some nestlings. In this classification of birds' enemies I refer mainly to conditions prevailing in eastern Massachusetts, which is a thickly settled region; in a less thickly settled or more open country, a change in the relative positions of birds' enemies might more nearly approximate the facts.

Properly speaking, man is the greatest enemy of the birds. Cats, dogs and English sparrows have been both introduced and fostered by him. Birds are killed by him for ornamental purposes and for sport, instead of being given that consideration and protection which is their due, and which man can readily afford them. Cats are named first as bird enemies, because they are exceedingly numerous in the vicinity of cities, towns and villages, and because an adult cat, in good hunting grounds, will probably destroy about fifty birds each season. I have known a single cat to kill all the nestlings in six nests in one day, with two of the old birds struck down while trying to defend their young.

No doubt this is exceptional; but few nests are secure from these cruel marauders, except those which are inaccessible, like many of the nests of the Baltimore oriole. Most farmers keep too many cats. The country is infested with vagrant cats. Hounds often "tree" them in the woods far from any house, and their tracks may be seen in every newly fallen

snow. Cats are turned out by people who wish to get rid of them. Many are abandoned by city people when going back to town from their summer homes. Some may take to the woods from choice. All this is bad for the birds. Many such cats inhabit the woods and thickets about Wareham, living on birds, mice, squirrels and insects; haunting back yards, poultry coops and barns; stealing any food that may be left in exposed situations; making the raising of chickens a precarious business; and even killing rabbits, pheasants, partridges and half-grown fowls. Such cats are largely responsible for the fact that many of the ground-breeding and bush-inhabiting birds in our neighborhood have been killed or driven away. Careful investigation will show a somewhat similar condition in many neighborhoods. For this there is only one remedy, — these cats must be exterminated.

Twenty years ago the English sparrow would have been placed first on the list, but it is not now so serious a menace to our native birds as then. The conditions for its increase are not generally so favorable as they then were, and its enemies are more in the ascendant. It should not be tolerated, however, by any one living in the country who prefers the presence of our many beautiful and far more useful native species. If its presence is allowed, it is likely to drive out all those native birds that nest in or about buildings or in bird houses. It also annoys many other birds, and drives them from the neighborhood of our homes. I have now driven it out of this neighborhood, but its former presence accounts for the absence of wrens, bluebirds, phœbes and swallows, which no doubt once bred here, and may now be induced to return. The sparrows — according to the testimony of many observers — do not kill the native birds and their young to the extent that they did some years ago; but they often destroy the nests of other birds, and they still persist in following or mobbing birds of other species, and compelling them to move on. If their nests are destroyed and the birds shot whenever occasion offers, the survivors usually learn to keep away.

In speaking of the gunner as an enemy of birds, it may be well to except the honest sportsman, who complies with the law, respects the rights of property, and is intelligent enough

to know that it is for his own interest to protect all birds from undue or illegal slaughter. We may except also the scientific ornithologist, who kills birds only when necessary to further the interests of science. In the present state of ornithological science, there are very few men who should find it necessary to kill many birds for this purpose. It is the irresponsible gunner — boy or man, who shoots, in season or out, anything which comes within the range of his gun, from a hen to a chickadee, for sport or practice, as the case may be — who should be suppressed. The trolley cars, which flood the country, especially on Sundays and other holidays, with gunners and fishermen from the cities, have increased the danger to the birds from this class of people. A large proportion of these people are foreigners, or of foreign extraction. Since the trolley roads came into Wareham, we have had occasion to warn many of these people away from the premises. Usually when spoken to they have replied in broken English. Many of these foreigners shoot and trap song birds to eat. The natural destructive propensities of our own children may readily be controlled by education, by teaching them to take an interest in birds, their songs and habits, and by showing them their usefulness.

Having done what we could to protect the birds about the farm from cats, dogs, gunners, English sparrows and boys, we are still confronted with the undeniable fact that most species of birds about the place are not increasing in numbers, while some of them are decreasing. Some fail to breed at all, while some are entirely absent in the breeding season. The explanation of this lies largely in the fact that under protection the jays increased mainly the first year, while the crows are increasing regularly, and frequenting the place more and more. It is to be regretted that, where all birds are protected by man, *birds are the greatest enemies of birds.* I have previously reported[1] that in the Middlesex Fells reservation near Boston the crows appeared to have increased at the expense of the smaller birds. This region came under my observation in 1891, when the committee in charge of the gypsy moth work was first appointed. From that time until 1900 several observers

[1] Agriculture of Massachusetts, 1900, p. 50.

who were well acquainted with the birds of the region passed much of their time in these Fells. In 1891 the land was owned mainly by individuals, and was a great resort for gunners. Hares and grouse were rare. Crows and jays were not exceedingly common, and the smaller land birds were found in such numbers as are usual about our cities. Within two years after the Metropolitan Park Commission took the land, and stopped gunning, trapping and snaring by a remarkably efficient system of police protection, hares, grouse, jays and crows became much more numerous, but many of the smaller birds which breed in the Fells decreased somewhat in numbers. Our observers found that the eggs and young of these birds were being destroyed mainly by crows and jays, which were often seen during the breeding season searching the woods for them and destroying them.

Most farmers know the bird-nesting habits of the crow, — how it sneaks about the house and orchard in the early morning hours, stealing eggs and nestlings from the nests of robins and other small birds. Similar habits of the jays are also notorious. Still, it is not so very often that these birds are actually seen in the act of eating the eggs of small birds. Crows may commonly be seen to destroy the eggs of herons or sea birds, when these birds are frightened from their breeding places by the approach of men. In their eagerness to secure the eggs or young before the return of the parents, crows sometimes become quite daring. This trait of their character I have observed often when in heronries or on the rocky islands of the coast, where sea birds breed; but it is far more difficult to catch them in the act of robbing the nests of small birds, which are scattered singly in woods, groves, orchards and undergrowth, where the crow or jay can readily keep in hiding behind the foliage.

When we first occupied the farm in Wareham, two pairs of jays were breeding in the "robin roost," but no crows bred in the woods about the place. Both crows and jays were very shy. Crows seldom came into the "robin roost," nor were they troublesome about the farm. Under such protection as we were able to give, the jays increased so that by January, 1902, there were at least fifteen pairs in the "robin roost" and about the farmyard. They had become so tame by this time that they

would come to our windows to feed. Many other jays, also, finding here a comparatively safe retreat and some food always at hand, made the place their winter quarters. In the mean time, the crows also had increased largely. They bred mainly in the woods of a neighboring farm, but fed much about our place. As time passed and they were not molested, they became more and more bold, taking eggs and chickens from the poultry yards, and cautiously searching among the trees, apparently for eggs and young birds. They did this persistently, but kept their movements so well covered that they would hardly have been noticed except for the cries of the parent birds, and their habit of pursuing the crows which came near their nests. A few birds beside the robin and the chickadee were able to raise their broods in 1901, but in 1902 the *chickadees, pine warblers and Maryland yellowthroats were the only birds smaller than a towhee that were known to raise any young.*

Kingbirds, robins, brown thrashers, towhees and birds of this size were able, though much persecuted, to raise some young; but, so far as we could discover, nearly all the smaller birds, such as warblers, sparrows and vireos, failed to raise any, while several species made no attempt to breed here, but left, presumably for safer quarters. The nests of all these small species were persistently robbed. Most of them never hatched an egg. In some places their eggs were stolen before the full complement was laid. The chipping sparrows in a small apple tree by the house, having lost their first and second set of eggs, built a nest on a branch of a tall pine, only to lose the eggs as before. A pair of vireos changed the location of their nest, with similar results. The ground-breeding birds suffered less. A pair of song sparrows, as before stated, were able to hatch their young. Towhees hatched and reared at least two broods. The nests of the oven-birds seemed to escape the marauders, but no young birds were seen later in the woods. No doubt the partial immunity of these ground-breeding birds from the attacks of their bird enemies lies in the fact of the careful concealment of their nests. They are more likely to be found, however, by their four-footed enemies.

Robins, brown thrashers, blackbirds, kingbirds, orioles and jays seemed better able than the smaller birds to protect them-

selves from the attacks of the common enemy. The jays seldom were able to get a robin's egg if there was a robin within sight. In such a case the alarm was given, and the jay was immediately attacked by robins. Both robins and jays bred all about, and fights between the two species were of daily occurrence. Usually the robins were engaged in driving the jays away from robins' nests, but occasionally the jays seemed to be defending their own nests from the robins. The robins vigorously protested whenever a stealthy crow appeared. Nevertheless, many of the robins' eggs were destroyed. The present year (1902) the crows have become so emboldened by their immunity from harm that they have frequented the farm more than ever, so that now even the blue jays find it difficult to raise young. Young robins and jays have been comparatively scarce. The crows are becoming more bold, and the situation grows worse as time passes. There is no time here to discuss the economic position of the crow, or to enlarge upon the services of the jay as an insect destroyer; the Board has already received my reports on these matters. It is enough to say here that, if we wish to protect our smaller birds and increase their numbers, both crow and jay must be kept within bounds.

Our Massachusetts laws do not protect these birds; in this they are wise. The beauty and grace of the jay cannot compensate us for the loss of many other beautiful and useful birds; and, while the crow has its place, and is at times very valuable to the farmer, it can never fill the place about the farmyard and orchard which is now so well filled by the robins, bluebirds, sparrows, warblers, vireos, wrens and thrushes. Crows and jays, like all creatures of omnivorous habits, are likely to become pests wherever they become unduly numerous. Although the crow has many enemies, there are few crafty or powerful enough to destroy him. The caution and intelligence of the crow are proverbial. Crows, by the strength of their combined numbers, are able to defy even the eagle. They have really only one effective enemy besides man, and that is the great horned owl. Years ago, while studying crow roosts in Worcester County, I found that something was killing crows about these roosts. The remains consisted mainly of feathers, nearly the entire crow having been devoured in each case. After the first fresh snow-

fall I visited an extensive roost, finding the feathers and a few other remains of a freshly killed crow. At the spot where the crow was borne to the ground were found the strong imprints of the characteristic wing tips of the great horned owl. These owls habitually take crows from their roosts or nests at night. In return, the crows always mob an owl if they can find one in the day time. While we have been proscribing the crow and shooting it at sight, we have been protecting it by shooting every owl that comes within range of our guns. No doubt it is mainly for this reason that crows have multiplied, in spite of this persecution. In our "robin roost" the crows are now in the ascendant; even the jays raised but three broods there last season. One brood was taken by a hawk and one at least by crows before they were fully fledged.[1]

Hawks are better fitted perhaps than any other creature to pursue and kill other birds, and certain of them may be regarded as among the worst enemies of birds; but they have not been placed first in our list of bird enemies, because they are not especially numerous in the vicinity of the farm. Although all hawks when hungry will seize other birds whenever they can get them, there are only a few that are quick enough to follow and catch small birds in flight. Most of our hawks, therefore, content themselves mainly with picking up such insects, small mammals, reptiles and frogs as they can easily get, and such birds as they are able to catch unawares. The Cooper hawk, sharp-shinned hawk and duck hawk, which are among the greatest enemies of small birds, are not common about the farm at present, although the sharp-shinned hawk is occasionally seen. There is really but one hawk, in the neighborhood, that kills many birds or chickens, and that is the marsh hawk, which is now usually regarded as one of the most useful of all hawks.

This hawk is frequently held up as a model by popular writers on bird protection. Such expressions as, "it never touches a chicken," and "seldom kills birds," have been frequently used. Here, however, a hungry marsh hawk will take a chicken or a bird when a good chance presents itself. I have known the marsh hawk to kill snipe, song sparrows, young blue jays and

[1] Crows are sometimes attacked by a contagious disease, either identical with or similar to the roup of poultry. See "The Auk," Vol. XX., p. 57.

many chickens. The bird is often followed by the blackbirds, which may indicate that their nests have been robbed by it. All along the southeastern shore of Massachusetts from Dartmouth to Plymouth this bird is recognized as a chicken thief. It will glide into the barnyard, seize a young chicken and bear it away to a tree in the woods or low spot of ground, where nothing will remain to tell the tale but the scattered feathers. Well knowing the value of the marsh hawk as a mouser, I was for some years loath to believe the stories told by farmers and poultrymen of its ravages in the poultry yard; but during the past two years I have seen these birds strike and carry off chickens both in the yard and in the open. Having lost about forty chickens, the shot gun was brought into requisition, and but two more were lost that season. The marsh hawk could not kill chickens when half grown, as the birds were then strong enough to escape; but small chickens are not safe from this bird in our vicinity unless they can be kept shut up. These birds beat over the meadows and sweep over patches of woodland, snatching young birds from their nests and flying away pursued by the screaming parents. There is little doubt, however, that this hawk, so long as it confines itself to its usual habitat in the fields and meadows, is among the most useful of our native birds, for there its prey consists largely of field mice and other small mammals which are believed to be mainly injurious.

The only snake that has been seen to kill birds in this locality is the black snake, and as these reptiles are not very common, their depredations are not very serious. This snake devours the young ground-breeding birds, and probably the eggs also. It often climbs bushes and trees, and, coiling itself around the nests of robins, thrashers or catbirds, devours the young in the most deliberate fashion, the old birds in the mean time fluttering about in distress, or doing battle with the enemy as best they may. Occasionally in the summer the birds may be seen crowding to a certain tree or thicket and uttering cries of distress. This is always the signal for some one to go to their relief, and nearly always a cat or a snake is found to be the cause of the trouble. These snakes often catch fully fledged young, when, or soon after, they leave the nest.

Skunks are so useful in killing insects that the comparatively

few birds' eggs they eat cannot count heavily against them. Weasels are not plentiful enough in the neighborhood seriously to affect bird life. To what extent dogs and foxes destroy the eggs and young of ground birds can only be conjectured. The smaller owls and the shrikes or butcher birds kill some small birds; but, as they kill mice and English sparrows, the good they accomplish overbalances the harm done.

I approach the name of the squirrel with some reluctance, for squirrels are general favorites among those who appreciate the beauties of nature. Their grace and beauty, their sprightly and companionable ways, and their tendency to confide in us when allowed to do so, have endeared them to many a lonely soul. But the farmer considers all squirrels pests, and rightly so. There is no animal which can do the farmer so much injury in proportion to its size as the squirrel. Squirrels not only carry off enormous quantities of corn, but they destroy far more strawberries than birds do, and they ruin ten times as many pears, peaches and grapes as they can possibly make use of. The fruit is bitten, and then thrown to the ground to rot. They will go over planted ground and dig up the seed of squashes. They will pull or dig up the young corn about as fast as a crow. They are the very incarnation of mischief. The red squirrel is perhaps the more mischievous, but the gray squirrel is not far behind it. It may be this spirit of mischief that impels them to break up the nests of birds. That they do this is not open to doubt. A pair of gray squirrels was seen in the "robin roost" in July, 1900. They were not molested, and soon became so confiding that they built a nest in a dove cote in the barn the ensuing winter, incidentally driving out all the pigeons, who left never to return.

Two broods of young ones were raised in the barn; then nest building was begun in the pines. The squirrels increased rapidly, and in 1902 six or eight pairs were breeding in the vicinity. Red squirrels were also quite plentiful. The gray squirrels made frequent attempts on the nests of both jays and robins; but, as both birds always joined forces to repel the common enemy, the squirrels were frequently driven off. They were not seen to accomplish their object, but no doubt they did so in some cases. The actions of the birds told that

they well realized the danger, and were determined to conquer or die. The gray squirrels are not so active as the reds; but either of them are likely, when opportunity offers, to eat birds' eggs or kill the young. Mr. F. H. Mosher writes me from Hyde Park, N. Y., that the squirrels there upset birds' nests quite wantonly; also that they bite off the heads of young birds and throw the bodies to the ground. It is difficult to judge how universal such habits are among squirrels, but where they are observed, it is safest to kill the squirrels at once.

I have dwelt at some length on the habits of the creatures that contribute to restrain the increase of birds, that we may fully realize the importance of protecting birds against these enemies. If the smaller birds are to resume even their normal numbers, a different policy must be pursued from that heretofore adopted. Bird protection means something more than the ordinary interpretation of the term. If we wish to protect the smaller birds, we must banish or destroy any excess of their natural enemies. How this is to be done, and just what its effect will be if it succeeds, is the next subject for inquiry. These questions can be answered only by the experience of the future.

The most important conclusion that has been confirmed by these two years of bird study is that the *Corvidæ* (crows and jays) are very largely responsible for the decrease of the smaller birds. I am well aware that some investigators will not agree with this conclusion; but it has been forced upon me by the experience of thirty years and the corroborative observations of the last two. No one can doubt that in the great plan of nature these birds fill well their place. Their usefulness as insect destroyers is well known; but where they become too numerous, their supply of insect food is soon so limited that they must turn to other sources for a good part of their animal food; then small birds and young chickens suffer. Could the crows and jays hold in check those insects that, in consequence of the destruction of small birds, are allowed to increase, then the destructive propensities of the crow family need not be viewed with alarm. That they can do this is im-

probable. By protection, we have made it possible for these birds to increase. We must remove this protection, or remove the surplus *Corvidæ*.

Domestic Fowls as Insect Destroyers.

Common fowls, if rightly handled, may be made most useful as insect destroyers in garden and field. We utilize the services of young chicks in the garden by keeping the mother hens confined there in small coops along the borders. Then each brood of little chicks can have the run of that part of the garden nearest the coop, as well as the grass near by. Young chicks, kept in this way, soon learn to eat such garden pests as are turned up by the plow or other garden implements. They are fond of small caterpillars, maggots and cabbage plant lice, and some of them will learn to eat the small larvæ of the potato beetles. With us they have not learned to eat the melon plant lice or the squash insects. But few birds of any kind have been seen to eat these pests.

Young chicks may be safely kept in gardens until five or six weeks old, when they will begin to eat the vegetables. Ducklings are useful, but more destructive than chicks. They are very fond of radishes, and will devour them when very small. All this is not new to many farmers, but not all are aware that large chickens or even full-grown fowls sometimes may be used to check insect invasions in the garden. If hens are kept well supplied with green food, grain and water, they may be turned into the garden occasionally, to follow plow, cultivator or wheel hoe. They soon learn that in following such implements they will find angle worms, cutworms, wireworms and other insect food, and they will seldom do much injury to the garden while so engaged. If they have not been liberally supplied with such grain, green food and water as they need, they will attack both vegetables and fruits. Most farmers know that fowls will clear fields infested with grasshoppers, crickets and army worms. Ducks are particularly fond of army worms, and a flock of five hundred ducks ought to be able to stop the progress of these destructive pests on any farm. It is said that young turkeys may be taught to eat the larva of the Colorado

potato beetle, and will clear the vines of this pest. Some ducks eat this insect. Mr. E. H. Kern of Mankato, Kan., writes that his ducks cleared the bugs from the potato field. So far as his experience goes, all ducks like these insects, and seem to grow fat by feeding on them. [1]

Chickens will destroy the maggots of the common house fly, and thus prevent the increase of this pest. Dr. Howard, chief entomologist of the United States Department of Agriculture, tells us that these flies breed chiefly in horse manure, and also in human excreta.[2] He tells how to prevent their increase in vaults and manure piles by the use of chloride of lime. We find that a few chickens confined where they can scratch over the stable manure are effective, and less expensive than the chloride of lime. They will spend much time scratching and digging over this manure, looking for partially digested grain, seeds and maggots. This scratching fines up and dries out the manure, rendering it an unfit breeding place for flies; but if any maggots appear, they are soon eaten.

While there are some insect pests that are not eaten to any extent by either wild birds or poultry, most of them may be controlled by one or the other. Young chickens, and even mature fowls, eat a great many weed seeds. Fowls may be used to take the place, in a measure, of the wild turkey, partridge, heath hen, wild pigeon and quail, once plentiful in Massachusetts, but now in one case exterminated and in the others altogether too rare. The man who raises one thousand chickens, five hundred ducks and a few turkeys each year, has under control a police force sufficient to check any invasion of such grass, grain or garden insects as poultry will eat; but we must still depend largely on the wild birds to hold the tree-inhabiting insects in check.

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[1] Insect Life, Vol. III., p. 398.

[2] Circular No. 35, second series, Division of Entomology, United States Department of Agriculture.

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